IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of
NORBERT CONRADS et al.

Atty. Docket
PHN 16,136

Serial No.: 09/826,256

Group Art Unit: 2882

Filed: April 4, 2001

Examiner: C. Church

Title: X-RAY EXAMINATION APPARATUS WITH X-RAY IMAGE SENSOR MATRIX AND CORRECTION UNIT

Commissioner For Patents
Washington, D.C. 20231

Sir:

Enclosed is an original and two (2) copies of an Appeal Brief for submission in the above-identified patent application.

Please charge the fee of $320, as well as any additional fee due on Appeal, or overpayment, to Deposit account No. 14-1270.

Respectfully submitted,

By _____
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On June 12, 2002

By _____

phn-1613A.appeal

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
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#8
B. 3-02
C Boesen

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Applicants' Brief On Appeal

Applicants, their Notice of Appeal mailed today, March 13, 2002, concurrently herewith, present their Brief on appeal as follows:

Real Party In Interest

The real party in interest is the assignee of the application, Philips Electronics America Corporation, a Delaware corporation having its principle place of business at 1251 Avenue of the Americas, New York, NY 10020-1104. Koninklijke Philips Electronics, N.V., a corporation organized under the laws of The Netherlands, with offices at Groenenwoudseweg 1, Eindhoven, The Netherlands, is the parent of Philips Electronics North America Corporation.

Related Appeals and Interferences

There are no other appeals and no appearances known to appellant or the assignee of this application which will directly affect, or will be directly affected by, or have bearing on, the Board's decision in this appeal.

Status of the Claims

This is appeal is from the decision by Examiner Church dated January 2, 2002, finally rejecting claims 1, 2 and 4-8, which claims are each pending in this application.

Status of Amendments

An Amendment was filed on October 2, 2001, in this case in response to an Office Action mailed from the US Patent Office on July 2, 2001. In the final Office Action (dated January 2, 2002), Examiner Church asserts that applicants' argument included in the October 2, 2001 Amendment proved unpersuasive, and based thereon, finally rejected claims 1, 2 and 4-8 in view of US Patent No. 5,974,113 to Bruijns, et al. (Bruijns).

Summary of the Invention

Applicants' inventions are directed to an x-ray examination apparatus (and method) which includes an x-ray image sensor matrix, an x-ray image correction unit with a memory and an arithmetic correction unit. X-ray radiation incident upon the x-ray image sensor matrix generates charge carriers corresponding to image intensity. Some portions of the CCDs making up the matrix delay the release of charge generated therein pursuant to x-ray exposure. A problem results because the charge released after delay become incorporated into a "present" image, causing what are referred to as after images. The after images degrade the instant image.

By use of applicants' apparatus, a corrected image signal may be realized for viewing which is substantially free of after images from previously generated x-ray image signals. That is, applicants apparatus generates a corrected image signal which provides a corrected image that is free from after images resulting from charges trapped within the x-ray image sensor matrix and released after a delay time.

Applicants' method derives a calibrated image signal by irradiating the image sensor matrix with a predetermined calibrated x-ray exposure. They then generate correction values using the calibrated image signal, and store the correction

values in a memory. Applicants then radiate an object for examination and derive an instant image signal from the image sensor matrix based on the radiating, and correct the instant image signal to form the corrected image signal by processing the instant image signal in the x-ray image correction unit based on at least one of the memory-stored correction values. The correction values provide that any effects related to the delayed charge release effects are considered during processing within the x-ray image correction unit.

In summary, applicants' claimed inventions determine the particular time-varying characteristics of the image sensor matrix, i.e., how the sensor matrix traps charge and releases them over time, incorporating the detected information (time-varying, delayed-charge-related statistics) into correction values.

Correction values are derived from the calibration image signal, in particular, by performing a best fit to a mathematical model, such as that described at page 3, line 20-page 4, line 14, of applicants' specification. Sets of correction values are stored for separate values of a number of preceding x-ray pulses, the x-ray pulse rate, respective intensities of the preceding x-ray pulses. Each set includes

correction values representing variations of the time lapsed since the latest x-ray pulse.

Such sets of correction values may also be directly calculated from a calibration signal sequence without calculations based on the mathematical model, by reading out the x-ray image sensor matrix at several moments after the latest x-ray exposure. Again, any calculation is based on the fact that the signal levels of the calibration signal sequence represents the decay of trapped charges as time goes on.

Issue

The issue on appeal is whether claims 1, 2 and 4-8 are obvious under 35 USC § 103(a) in view of US Patent No. 5,974,113 to Bruijns, et a. (Bruijns).

Grouping of Claims

For the purposes of this appeal, all of claims 1, 2 and 4-7 and 8 will be grouped together. Dependent claims 2 and 4-7, which depend from independent claim 1, shall stand or fall together controlled by the fate of independent claim 1. Independent claim 8 is a method claim which, when carried out, provides a similar function as that provided by applicants' apparatus of claim 1.

All of claims 1, and 4-8 are asserted by Examiner Church to be unpatentable over Bruijn's system, because Bruijn's system uses dark current correction. And while the claimed inventions are directed to correcting for after images generated by release of trapped or delayed charge carriers, Examiner Church states that "Bruijns does not specify that his method is performed *to take delayed charges into* consideration, [but] the reason to performing the recited steps is no patentably germane."

Argument

Applicants' Independent Claims 1 and 8

Independent claim 1 discloses an x-ray examination apparatus comprising an x-ray image sensor matrix for deriving an initial image signal from a predetermined calibrated x-ray exposure, and an initial image signal from an x-ray image. The invention also discloses a correction unit for deriving a corrected image signal from the initial image signal, which correction unit includes a memory for storing correction values derived from the calibration image signal. The correction unit also includes an arithmetic unit for computing signal levels of the corrected image signal from a calibration of: 1) signal levels of the initial image signal and 2) at least some of the

correction values in order to take delayed charges into consideration during the correction.

Applicants' independent claim 8 calls out a method for performing an x-ray examination utilizing an x-ray examination apparatus with an x-ray image sensor matrix, and an x-ray image correction unit with a memory and arithmetic correction unit. Applicants' method includes deriving a calibrated image signal by irradiating the image sensor matrix with a predetermined calibrated x-ray exposure, generating correction values from the calibrated image signal, storing the correction values in a memory, radiating an object for examination and deriving an instant image signal from the image sensor matrix pursuant to the radiating. The method then includes correcting the instant image signal to form the corrected image signal by processing the instant image signal in the x-ray image correction unit in accordance with at least one of said memory-stored correction values. This takes delayed charges into consideration during correction, wherein the resulting corrected image signal presented for viewing is substantially free of after images from previously generated x-ray image signals.

Discussion of the References Applied by Examiner Church

Bruijns

Bruijns discloses an x-ray examination apparatus with an x-ray source to form an x-ray image of an object, an x-ray detector for deriving an optical image from the x-ray image, an image pick-up apparatus including one or more image sensors for deriving sub-image signals of the optical image, and a combination unit for combining the sub-image signals to form a composite image. The Bruijns apparatus further includes a correction unit to correct for variations of brightness values of the sub-images with respect to offset and gain differences inadvertently generated by the different image sensors, and the disturbances which are a consequence of said differences, e.g., a streaky pattern.

Bruijns does not disclose a correction unit with an ability to correct the ill effects of delayed emissions based on correction values obtained from **a separate calibration of the examination process, as claimed**. Put another way, while Bruijns correction unit corrects images in order to overcome offset gain difference results from different image sensor portions, Bruijns was not designed to correct for the delayed emission of electric charges trapped in the semiconductor material comprising the matrix from an **earlier X-ray exposure, such a basic part of each**

of applicants' claimed inventions. Bruijns' correction unit does not address imaging problems resulting from after image signals arising from trapped charge carriers, and the effect of such after images have on instant images.

As mentioned above, Bruijns makes corrections on the basis of dark current values stored in memory units, the known corrections are unable to take delayed charges into its calculations. Bruijns does not include an x-ray image sensor matrix for deriving a calibration image signal from a predetermined calibrated x-ray exposure and an initial image signal from an x-ray image. Bruijns does not disclose a correction unit for deriving a corrected image signal from the initial image signal, including a memory for storing correction values derived from a calibration image signal and an arithmetic unit for computing signal levels of the corrected image signal using at least some of the correction values, as claimed.

The Rejections

The rejection of independent claim 1 is based on Examiner Church's assertion that Bruijns discloses an x-ray imaging system with a source 21, image intensifier 24, sensor arrays 2,3, arithmetic unit 10 for calculating image correction values, a memory 41 for storing pre-calculated correction values, an

image processor 7,8 to calculate a corrected image from a current image and correction values including dark current correction and display 35.

Examiner Church points out that while Bruijns at lines 42-55, col. 7, teaches memory operation, Bruijns does not specify that his method is performed to take delayed charges into consideration, but that the reason for performing the recited steps is not patently germane, that the delayed charge would be indistinguishable from dark current which Bruijns does correct for.

Applicants' Position

Compensation values used to correct for improper intensity level determinations as a result of the after image effects of delayed, trapped charge in a sensor matrix is germane to the claims of this application.

Claim 1 is not obvious by Bruijns since Bruijns' correction unit does not disclose, teach or suggest an x-ray image sensor matrix for deriving a calibration image signal from a predetermined calibrated x-ray exposure and an initial image signal from an x-ray image, with a correction unit for deriving a corrected image signal from the initial image signal. This is particularly so in view of the clearly stated limitation in

applicants, claims language that the correction unit includes a memory for storing correction values derived from the calibration image signal and an arithmetic unit for computing signal levels of the corrected image signal from signal levels of the initial image signal and at least some of said correction values to take delayed charges into consideration during correction.

More particularly, and germane to patentability is the fact that the claimed correction unit has an ability to correct the ill effects of delayed emissions based on correction values obtained from **a separate calibration of the examination process**. Applicants' correction unit is designed to correct for the delayed emission of electric charges trapped in the semiconductor material comprising the matrix from an **earlier X-ray exposure,** not through the use of sub-image signals as taught by Bruijns.

By use of at least one correction value derived from electric charges emitted during read-out after one or more periods of time since a pre-selected number of x-ray pulses with pre-selected pulse-length, pulse rate and x-ray dose per pulse irradiate its single x-ray sensor image matrix, the claimed inventions use the at least one correction value to correct the instant image signal.

Bruijns' correction unit does not address imaging problems resulting from after image signals arising from trapped charge carriers, and the effect of such after images on instant images.

Bruijns makes corrections on the basis of dark current values stored in memory units, the known corrections are unable to take delayed charges into its calculations. Hence, claims 1, 2 and 4-8 cannot be said to be obvious under 35 USC § 103(a) in view of Bruijns.

Conclusion

It is respectfully submitted that all rejections are erroneous and that all claims are allowable. Wherefore, it is further respectfully requested that Examiner Sealey's decision finally rejecting claims 1, 2 and 4-8 be reversed in all respects.

Respectfully submitted,

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On June 12, 2003

By

APPENDIX

Claims on Appeal:

1. An x-ray examination apparatus comprising

an x-ray image sensor matrix for deriving an initial image signal from a predetermined calibrated x-ray exposure, and an initial image signal from an x-ray image, and

a correction unit for deriving a corrected image signal from the initial image signal, wherein the correction unit includes a memory for storing correction values derived from the calibration image signal and an arithmetic unit for computing signal levels of the corrected image signal from signal levels of the initial image signal and at least some of said correction values in order to take delayed charges into consideration during correction.

2. An x-ray examination apparatus as claimed in Claim 1, wherein the correction unit includes a selection unit for selecting correction values from the memory on the basis of exposure parameters.

4. An x-ray examination apparatus as claimed in Claim 1, wherein the arithmetic unit is arranged to compute accurate

correction values, from the stored correction values derived from the calibration image signal, and to compute signal levels of the corrected image signal from signal levels of the initial image signal and said accurate correction values.

5. An x-ray examination apparatus as claimed in Claim 4, wherein the arithmetic unit is arranged to interpolate said computed correction values between stored correction values.

6. The x-ray examination apparatus as claimed in claim 1, wherein the arithmetic unit is arranged to compute accurate correction values from stored correction values, and to compute signal levels of the corrected image signal from signal levels of the initial image signal and said accurate correction values.

7. The x-ray examination apparatus as claimed in claim 6, wherein the arithmetic unit is arranged to interpolate said computed correction values between stored correction values.

8. A method for performing an x-ray examination utilizing an x-ray examination apparatus having an x-ray image sensor matrix and an x-ray image correction unit with a memory and arithmetic correction unit wherein a resulting corrected image signal

presented for viewing is substantially free of after images from previously generated x-ray image signals, the method comprising the steps of:

deriving a calibrated image signal by irradiating the image sensor matrix with a predetermined calibrated x-ray exposure;

generating correction values from the calibrated image signal;

storing the correction values in a memory;

radiating an object for examination and deriving an instant image signal from the image sensor matrix pursuant to said radiating; and

correcting the instant image signal to form the corrected image signal by processing the instant image signal in the x-ray image correction unit in accordance with at least one of said memory-stored correction values in order to take delayed charges into consideration during correction.

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RESPONSE TO NOTICE OF NON-COMPLIANCE UNDER 37 CFR 1.192(c)

Sir:

Responsive to the Office Action dated MAY 13, 2002, enclosed please find Appellants' amended Appeal Brief.

REMARKS

The Commissioner is hereby authorized to charge any fees which may be required, except the issue fee, or credit any overpayment to Account No. 14-1270.

Respectfully submitted,

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